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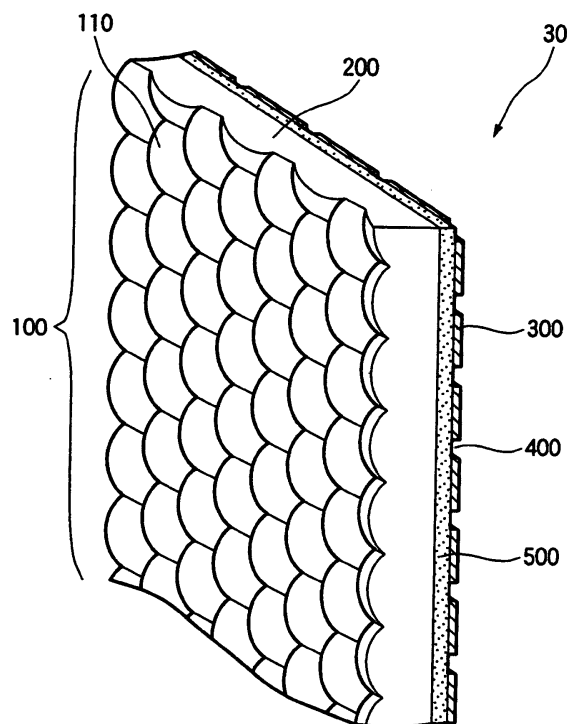
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(54) **Optical sheet and display device having the optical sheet**

(57) An optical sheet has a transparent base material; a fine lens array constituted by a plurality of fine unit lenses formed on a front surface of the transparent base material; a diffusing layer formed on a rear surface of the transparent base material opposite to the surface on which the fine lens array is formed; and a light absorbing layer formed on the diffusing layer and including fine opening portions substantially located at focal points of the unit lenses; wherein: the diffusing layer is made of a transparent medium containing transparent fine particles different in refractive index from the transparent medium; and the transparent fine particles have a mean particle size in a particle size range for maximizing a value of Q/R at each of wavelengths in a visible region when Q is a scattering sectional area per transparent fine particle, and R is a radius of each of the transparent fine particles.

FIG.1





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EUROPEAN SEARCH REPORT

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	PATENT ABSTRACTS OF JAPAN vol. 1998, no. 11, 30 September 1998 (1998-09-30) - & JP 10 160911 A (TOPPAN PRINTING CO LTD), 19 June 1998 (1998-06-19) * abstract; figure 2 *	1-4, 8, 9	G02B5/02
A	EP 0 945 742 A (DAINIPPON PRINTING CO LTD) 29 September 1999 (1999-09-29) * abstract; figure 6 *	1-3, 8, 9	
X	US 2001/015780 A1 (YAMAGUCHI AKIRA) 23 August 2001 (2001-08-23) * abstract; figures 7A, 7B *	5-7	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			G02B G02F G03B
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 15 December 2003	Examiner Daffner, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):
- ☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☒ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:



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LACK OF UNITY OF INVENTION
SHEET B

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-4, 8,9

An optical sheet in which a light absorbing layer is made of a transparent medium containing transparent fine particles of a specific mean size.

2. Claims: 5-7

An optical sheet in which a fine lens array is formed of hexagonally shaped lenses.

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 02 2929

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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Patent document cited in search report		Publication date	Patent family member(s)		Publication date
JP 10160911	A	19-06-1998	NONE		
EP 0945742	A	29-09-1999	JP	11084109 A	26-03-1999
			EP	0945742 A1	29-09-1999
			US	6169633 B1	02-01-2001
			WO	9913362 A1	18-03-1999
US 2001015780	A1	23-08-2001	JP	2001305315 A	31-10-2001

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82